REMARKS

Claims 25 and 36–48 are canceled in response to the Examiner's restriction requirement. Claim 26 is amended. Claims 26–35 remain pending.

The specification is amended to claim priority under 35 USC 120, making this application a CIP of application Serial No. 08/168,909 filed 12/17/93, which is to issue as U.S. Patent 5,497,140 on 3/5/96.

Applicant's Invention

Independent claim 26 and dependent claims 27–35 are directed to a method of manufacturing a radio frequency identification (RFID) transceiver. In the claimed invention, an RFID transceiver circuit and a battery are surrounded by two covers which are sealed together. Each cover is composed of a sheet of polymer film on which is deposited a material which is a barrier to water vapor.

The invention is especially useful for manufacturing extremely small and thin RFID transceivers, such as the example cited in Applicant's specification (page 4, lines 12–13) of a complete transceiver and battery in a package only 0.03 inches thick and one inch square.

The invention is important to such a miniature design because cover materials having the best barrier properties (imperviousness to water vapor and other contaminants) generally are unsuitable for other reasons. For example, a cover composed entirely of metal can have good barrier properties, but a metal cover is unsuitable for enclosing an RFID transceiver because the metal would block RF radiation. As another example, an entirely glass or silicon oxide cover would be unsuitably fragile and too easily cracked.

The invention permits fabrication of a superior cover by combining the advantages of two materials: a first material preferably having good durability but mediocre barrier properties, and a second material having mediocre durability but good barrier properties. Specifically, each cover is composed of a sheet of polymer film, which typically has mediocre barrier properties but readily can be produced so as to be quite durable even in a thin sheet. A water vapor barrier material is deposited on each cover. The barrier material can be a substance which would be unacceptably fragile if it were the sole material of the cover, such as silicon oxide or silicon nitride. By depositing the barrier material on the cover, the advantageous mechanical properties of the cover material are preserved, while gaining the superior barrier properties of the deposited barrier material.

Claims 26 and 27

Independent claim 26 and dependent claim 27 were rejected under 35 USC 103 as unpatentable over Anders et al. in view of Holland. The Anders reference merely discloses a transceiver connected to a battery. The Holland reference discloses a surface acoustic wave (SAW) device 15 which, when connected to an antenna 13, functions as a passive transponder, i.e., a

transponder not having a battery. The SAW device is a piezoelectric substrate 26 having interdigital transducers (IDT's) 17–23 on the top surface of the substrate, with a cover plate 29 overlying the IDT's. In one embodiment cited by the Examiner, the cover plate material may be "glass, silicon dioxide or even a suitable polymer".

The Examiner's rejection asserts it would have been obvious "to have provided covers including a polymeric or silicon barrier material with the device taught by Anders et al., since Holland recognizes the desirability of employing a protective cover having a conductive barrier material to propagate radio frequency waves in a transceiver device."

The Examiner overlooks the fact that Applicant's invention is not simply to provide a cover including a polymer ***or*** a silicon barrier. Instead, the claimed invention requires ***both*** a polymer and a barrier material. More specifically, the invention requires the deposition of a barrier material on a sheet of polymer film, thereby combining the advantages of the mechanical properties of the polymer film and the barrier properties of the barrier material. Holland lacks any disclosure or suggestion of depositing a barrier material on a sheet of polymer film, and therefore cannot be considered to teach or render obvious Applicant's invention.

Additional features of the claimed invention which are not disclosed or suggested by Anders or Holland are: (1) Applicant's cover is a polymer ***film***, not a plate as in Holland; and (2) Applicant ***encloses*** a transceiver and battery between ***two*** covers, whereas Holland has only ***one*** cover which overlies only a ***portion*** of one surface of a piezoelectric substrate, thereby failing to provide a complete vapor barrier.

Furthermore, a practitioner of ordinary skill in the art would have no motivation to combine the teachings of Anders and Holland. The motivation asserted by the Examiner is that "Holland recognizes the desirability of employing a protective cover having a conductive barrier material to propagate radio frequency waves in a transceiver device." However, the purpose of Holland's cover is the opposite of Applicant's with respect to RF wave propagation. Specifically, Holland's cover acts like a waveguide boundary, ***confining*** the acoustic waves on the surface of the piezoelectric substrate to the boundary between the cover and the substrate (column 7, lines 26–28). Radio waves are not propagated through Holland's cover; instead, they are received and transmitted by an antenna 13 which extends far beyond the perimeter of the cover 15 (see Holland's Figure 1). In other words, the disclosed purpose of Holland's cover is to confine acoustic waves to a boundary, thereby ***blocking*** the acoustic waves from being transmitted through the cover.

Since neither Anders nor the present invention relates either to acoustic waves or to confining the propagation of RF waves to a boundary between two surfaces, there is no motivation for a practitioner to employ Holland's cover for confining and blocking acoustic waves in combination with an RF transceiver such as disclosed by Anders or Applicant. In fact, Holland's concept of a cover for blocking wave transmission would prevent the RF transceiver disclosed by Anders or Applicant from receiving or transmitting RF waves, thereby preventing the transceiver from

operating! Therefore, Holland cannot be considered to render obvious the present invention when considered with Anders or any other reference disclosing an RF transceiver.

In summary, Anders merely discloses a transceiver connected to a battery. Holland discloses a cover, but fails to teach or suggest depositing a barrier material on a sheet of polymer film as in the claimed invention. Holland also fails to disclose a cover comprising a polymer film rather than a plate, and further fails to disclose enclosing a transceiver between a pair of the recited covers. Since the purpose of Holland's cover is to confine acoustic waves, a practitioner would have no motivation to employ Holland's cover for transparent transmission of radio waves. For each of these reasons, Applicant's invention is patentable over Anders in view of Holland, and allowance of claims 26–27 is requested.

Claims 28–35

Each of claims 28–35 is dependent on claim 26. Claims 28–35 are rejected under 35 USC 103 as unpatentable over the references as applied to claims 26–27, further in view of Christenson.

Each of dependent claims 28–35 is patentable for the same reasons independent claim 26 is patentable, as stated above. Additional reasons why claims 28–35 are patentable are as follows:

Claims 28 and 29

Claim 28 is directed to performing the depositing step by sputter deposition, chemical vapor deposition, or evaporation deposition. These deposition methods provide a more uniform, defect-free layer at the atomic or molecular level than grosser mechanical coating or lamination methods which typically are used for coating a polymer film. Claim 29, dependent on claim 28, is further directed to depositing silicon oxide or silicon nitride as the barrier material. These two materials, especially silicon nitride, provide especially good impermeability to water vapor and other contaminants.

The Examiner rejected claims 28 and 29 based on Christenson's disclosure of depositing silicon oxide and silicon nitride on a silicon wafer. The rejection is insupportable for several reasons:

First, the Examiner is incorrect in asserting that "Christenson teaches the deposition of a barrier layer on an electronic device" at col. 8, lines 44–50. The cited passage teaches the deposition of an electrically insulating layer, not a barrier against water vapor. It is well known that many electrical insulators are poor barriers against water vapor and other contaminants. In fact, the polymer film used in the present invention typically is a good insulator but a poor barrier, which is one reason why Applicant's invention of depositing a barrier material on the polymer film is valuable. Therefore, Christenson's teaching of an insulating layer would have no apparent relevance to a practitioner in the art seeking a water vapor barrier.

Second, the Examiner is incorrect in asserting that Christenson teaches that "silicon oxide or

silicon nitride (col. 8, lines 4–50) ... may be deposited by various methods including chemical vapor deposition (col. 5, lines 28–36)." To the contrary, Christenson lacks any teaching of depositing silicon oxide or silicon nitride by the processes recited in Applicant's claim 29. The Christenson passage cited by the Examiner at col. 5, lines 28–36, discusses only epitaxial processes for growing elemental silicon on a silicon substrate. Such processes are irrelevant to the deposition of silicon oxide or silicon nitride. Furthermore, such processes are irrelevant to the deposition of any material on a polymer film substrate as in Applicant's claims 28 and 29, because, by definition, epitaxial processes apply only to growing a crystalline layer on a ***crystalline substrate*** (see Sze, VLSI Technology, page 55).

In fact, no method of depositing silicon nitride is disclosed anywhere in Christenson. In the passage cited by the Examiner at column 8, lines 44–50, Christenson merely states that silicon oxide or silicon nitride should be deposited somehow on a silicon substrate, but no type of deposition process is suggested.

The only method Christenson discloses for creating silicon oxide is not a deposition process, but a process of thermally growing silicon oxide on the surface of a silicon wafer (col. 4, line 51), which means heating the silicon so that it oxidizes, i.e., so that the silicon substrate reacts with oxygen in the atmosphere to form silicon oxide. This method could not be used to create a silicon oxide layer on a material other than silicon, such as the polymer film required by claims 28 and 29.

In summary, Christenson lacks any teaching of depositing silicon oxide or silicon nitride by any of the processes recited in Applicant's claim 28, namely, chemical vapor deposition, sputter deposition, or evaporation deposition. In fact, Christenson does not disclose the use of sputter deposition or evaporation deposition for any purpose. Christenson's only disclosure of a chemical vapor deposition process is an epitaxial silicon process for growing crystalline silicon over a crystalline silicon substrate which, by definition, is irrelevant to the deposition of any material on a polymer film as in the claimed invention.

Therefore, Christenson does not disclose or suggest the deposition processes recited in claims 28 and 29, and allowance of these claims is requested.

Claims 30–32

Dependent claims 30–32 are further directed to depositing as the barrier material polyethylene, polyvinylidenechloride, or a fluorohalocarbon. The Examiner rejected these claims because "Holland suggests employing polymeric materials as barrier layers. Polyethylene and fluorohalocarbons are well known materials having the properties taught as desirable by Holland...." The Examiner cannot sustain a rejection based on the claimed materials being well known as having certain unspecified properties taught as desirable by Holland. The claims must be allowed unless the Examiner can cite specific prior art showing the materials as being a barrier to water vapor as required by the claimed invention. Even if the Examiner can cite such prior art, the

claims must be allowed unless the prior art renders obvious the specific processes claimed by Applicant. In the absence of such prior art, claims 30–32 must be considered allowable.

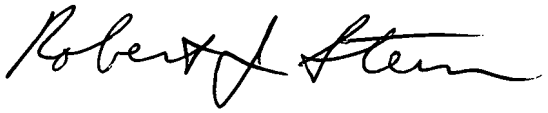
Claims 33–35

Claim 33 is further directed to depositing the barrier material in a thickness of 400 to 10,000 angstroms. Claim 35 is directed to depositing the barrier material on both sides of the cover in a thickness of 100 to 400 angstroms. One reason the recited thicknesses are important is that even the largest recited thickness — 10,000 angstroms or one micron — is so small as to have no significant effect on the mechanical properties of the polymer sheet on which the barrier material is deposited. This feature is important because good barrier materials such as silicon oxide and silicon nitride typically are fragile or susceptible to cracking. By depositing only a very thin layer of the barrier material on a sheet of polymer film, the advantages of the durability of the polymer film and the barrier properties of the barrier material can be achieved together. The undesirable permeability of the polymer film is overcome by the barrier material, and the undesirable fragility of the barrier material is overcome by the polymer film. Thus, the claimed invention combines the advantages of each material and overcomes their complementary disadvantages.

The Examiner rejected claims 33 and 35 based on the unsupported assertion that "the claimed deposition thicknesses would have been obvious to one skilled in the art during the course of routine experimentation." Applicant's attorney submits that it is not obvious to combine two dissimilar materials so as to obtain the best features of each while overcoming the worst features of each. Consequently, claims 33 and 35 are patentable, and their allowance is requested.

Claim 34 is directed to depositing the barrier material on both sides of a cover. An advantage of this process is that any pinholes or other microscopic defects in the barrier layer on one side of the cover are unlikely to coincide with defects on the other side. Consequently, the barrier layers can be much thinner than would be required to achieve the same barrier quality if the barrier material were deposited on only one side of the cover. None of the prior art discloses depositing a barrier layer on both sides of a cover, nor does the Examiner cite any prior art as teaching this feature. Accordingly, claim 34 is patentable, and its allowance is requested.

Respectfully submitted,



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